Alaska Department of Fish and Game
Division of Wildlife Conservation
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Analysis and Publication of Deer Research Data in Southeast Alaska and Evaluation of a New Passive Mark-recapture Technique

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Research Performance Report
Federal Aid in Wildlife Restoration
1 July 2000–30 June 2001
Grant W-27-4, Study 2.12

This is a progress report on continuing research. Information may be refined at a later date.

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FEDERAL AID
ANNUAL RESEARCH PERFORMANCE REPORT

PROJECT TITLE: Analysis and publication of deer research data in Southeast Alaska and evaluation of a new passive mark-recapture technique for estimating population size and survivorship of ungulates in forest habitats

AUTHOR: Matthew Kirchhoff

COOPERATORS: None

GRANT AND SEGMENT NR.: W-27-4

PROJECT NR.: 2.12

SEGMENT PERIOD: 30 June 2000 – 1 July 2001

STATE: Alaska

WORK LOCATION: Analysis and publication of deer research data was conducted primarily from the Douglas Office. The field testing of break-away radio collars for elk was conducted on Etolin Island.

I. PROGRESS ON PROJECT OBJECTIVES

OBJECTIVE 1: Summarize (or re-analyze) unpublished data on deer ecology in Southeast Alaska.

A number of data sets collected since 1978 existed in raw form, and had not been summarized or made ready for writing and publication. Now, all unpublished data sets have been cleaned, edited and summarized. I have shared a number of these with outside experts, including Dr. John Emlen (University of Washington), Dr. Robert Fagen (University of Alaska), and Dr. Bob Deal (Forestry Sciences Lab, Corvallis). They have made significant improvements, either by reanalyzing the data themselves (Emlen), or advising me on different approaches (Fagen and Deal). I expect to complete reanalysis of my retrospective study of selective logging (W-24-5, study 2.11) by the end of this report period. No other data analysis is anticipated other than what might be requested in the peer review process.

OBJECTIVE 2: Publish/present results to the public and to peers.

Two papers have been submitted and rejected; one of these is being revised and will be resubmitted. A number of papers have been submitted for presentation at meetings this report segment. Three were accepted at national or international meetings, and 3 others were accepted at an Alaska meeting. Manuscript preparation has been slowed due to time spent addressing 2 new objectives and jobs (January 2001 study amendment). To free up more of my time for writing, I am hiring a WB I (Kevin White) who will start October 1. Kevin's main responsibility will be develop and evaluate the capture methodology (objectives 3 and 4); allowing me to focus more of my time on manuscript preparation.

OBJECTIVE 3: Develop and test methods of radio-collaring forest-dwelling ungulates using break-away snares.

Objective 3 was added due to growing concerns about potential competition between deer and an expanding population of introduced elk (*Cervus elaphus*) on Etolin Island. Because conventional capture techniques were not possible, I proposed a new passive radio-tagging method that would use breakaway snares. Such captures are non-selective for age and sex, but have the advantage of low cost and are less invasive than methods requiring immobilization. Although success to date has been poor, I have learned from each failure and improved the snare design significantly. The snare collars are now refined, and this winter (after antlers have dropped) I will resume and expand the tagging efforts. I anticipate good success.

OBJECTIVE 4: Evaluate methods for estimating population size, cause-specific mortality, and patterns of habitat use/migration from passively radio-tagged animals.

Once animals are radio-collared, gathering data on habitat use, migration patterns, and mortality is straightforward. Gathering information on population size is more problematic, particularly if marked animals are difficult to sight. I plan to circumvent this problem by the use of remote data-loggers that passively record information on the proportion of animals marked (i.e., radio-tagged). While the theoretical basis for such work is sound, the data-logger technology is still untested. Moreover, the precision of any such estimates will require large sample sizes (both marks and "recaptures"), and adherence to important assumptions regarding geographic and demographic closure, and equal capture probabilities. Custom data loggers are currently being manufactured by Global Transmitter Systems Inc., with delivery of sample units expected in November. These devices will be used in addition to conventional aerial radio-telemetry to address this objective in the next report segment.

Note: Next segment period (1 July 2001-30 June 2002), objectives 3 and 4 will be covered in a separate federal aid report (W-27-5, job 15.1).

II. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD

JOB 1: Summarize/analyze data.

During this report period, I began reanalyzing dendrochronological data gathered in my retrospective study of selective logging on deer habitat (W-24-5, 2.11). This will result in slightly different cutting dates and growth responses for my 42 sample plots. Although it will alter my results quantitatively, I do not expect the qualitative conclusions to change. I expect to have this reanalysis completed in the next segment period.

I helped Michelle Kissling (a University of Idaho graduate student) analyze a long-term deer data set involving deer mortality data along beach transects and comparing that with upland habitat conditions. That work was accepted as a poster.

I helped Chris Farmer (W-24-5, job 14.16) with analysis of deer and vegetation data from Heceta Island. That work was accepted as an oral paper. A written paper on the vegetation work is in preparation.

I helped Julian Schwartz (a University Student I advised) analyze data on how snow accumulation and snowmelt influences the availability of *Vaccinium* browse in old-growth forest. That work was accepted as an oral paper.

With the exception of the selective logging data set mentioned above, I do not anticipate further data analyses unless recommended by outside peer review.

JOB 2: Publish and present results of deer research in Southeast Alaska.

No papers were published in this report period. Seven oral presentations were accepted at professional meetings or seminars (abstracts are included in the appendix):

Englestoft, C., M. D. Kirchhoff, and D. Eastman. 2001. Understory and black-tailed deer in old-growth forests on Haida Gwaii (Queen Charlotte Islands). Accepted at International Conference on Forest Dynamics and Ungulate Herbivory. Davos, Switzerland.

Farmer, C. J., D. K. Person, and M. D. Kirchhoff. 2001. Effects of even-aged timber management on survivorship of deer in Southeast Alaska. Paper accepted at the annual meeting of the Wildlife Society, Reno, Nevada.

Kirchhoff, M.D. 2001. Exotic Species in Alaska— implications for Alaska's native wildlife. Invited lecture at the University of Alaska, Southeast.

Kirchhoff, M. D., K. Titus, and D. K. Person, 2001. Science, politics and forest planning—strange bedfellows? Presentation as the Alaska Region Resource Mangement Conference, Sitka, Alaska.

Kirchhoff, M. D. and T. A. Hanley. 2001. Modeling deer-habitat relationships on the Tongass—where we've been and where we're going. Presentation at the Alaska Region Resource Management Conference, Sitka, Alaska.

Kissling, M., M. D. Kirchhoff, and E. O. Garten. 2001. Winter Mortality of deer in a fragmented island ecosystem. Poster accepted at the annual meeting of Society for Conservation Biology, Hilo, Hawaii.

Schwartz, J and M. D. Kirchhoff. 2001. Changes in availability of *Vaccinium* browse due to snowfall in southeast Alaska. Presentation at the Alaska Region Resource Management Conference, Sitka, Alaska.

JOB 3: Develop an effective way to radio-collar forest-dwelling ungulates using break-away snares.

During this report period I designed a prototype breakaway snare and solicited bids from 4 companies to manufacture transmitters to my size and weight specifications. All companies produced functional transmitters, however only Global Tracking Systems ($177.60 per unit) produced transmitters within the size and weight specifications in the contract, and delivered their transmitters on time. Both Telonics Inc. ($245.00 per unit) and Advanced Telemetry Systems ($173.08 per unit) produced rugged transmitters with metal cases, but exceeded specified size and weight limits by 3-4 times. AVM Instrument produced the least expensive transmitter ($170.79), but exceeded size specs (slightly) and missed the delivery deadline by months. Assuming all transmitter perform capably in the field (indications are thus far positive), Global Tracking Systems Inc. appears to have the best product and service, offered at a competitive price.

On 15-16 March 2001, 26 breakaway radio-snares were deployed along the southwest shore of Etolin Island from McHenry Anchorage south to Center Island. Snares were hung along heavily used elk trails in the beach-fringe forests. Each snare consisted of a transmitter attached to a plastic-covered 0.06 mm cable, an expansion segment (either surgical tubing or 0.013 mm bungee cord), and a one-way "y-catch" that allowed the cable to close around the animal's neck, but then relax to a pre-determined loop size. Once closed around the neck of an animal, collars ranged from 70-80 cm diameter, and expanded to maximum diameters of 102-123 cm. This range and flexibility was deemed necessary to accommodate the wide range of neck sizes found in adult male and female elk (Table 1).

Table 1. Maximum neck sizes and 95% confidence intervals for adult male (N=21) and female (N=21) elk collected in Colorado, December, 1992. (Values are estimated from a figure in an unpublished manuscript, courtesy of D. Freddy, CDOW research center, Ft. Collins.)

	Upper neck (95% CI)	Lower neck (95% CI)	Max lower neck size
Male	85-90 cm	110-117 cm	127 cm
Female	55-58 cm	70-75 cm	82 cm

In addition to the snares, most stations were also equipped with inexpensive disposable cameras that were designed to be triggered by a trip wire and capture an image of the animal being snared. Cameras were housed in wooden boxes to protect them from rain.

The snares were checked on April 15 after being out 60 days. 17 were checked on the ground. Of these, 6 had been tripped (35%), but none were successfully attached to elk. The other 9 transmitters were not visited, but were checked with a radio receiver to determine if they were on mortality mode or not. One of these (150.489, McHenry Anchorage) was transmitting on active mode, and was assumed to be on an elk. Tripped transmitters were retrieved from the field.

Eleven of the remaining transmitters were physically checked on 17 May. Five had been tripped (cumulative trip rate of 65%) but none successfully collared elk. All 11 sets were retrieved from the field. On 23 July, 6 of the remaining 7 sets were physically checked. All 6 had been tripped or disturbed, and 1 of these was missing. These snares were also retrieved from the field.

From these results, encounter rates are fairly high (68%), but capture success is obviously poor. Examination of the tripped snares suggests a number of problems. First, surgical tubing is an unacceptable expansion material. It degrades very rapidly in UV light, and is a weak link that broke in a number of sets. Bungee cord is more durable; but because it stretches readily, pressure applied by the snared animal probably causes the loop to increase in size rather than close tightly around the animal's neck. Finally, I suspect the snare noose loops were set too large. Animals that walked through the set probably had the snare catch low on the neck or shoulders. If so, it would be impossible to close past the one-way catch mechanism before the snare either broke away or the animal pulled free.

The next generation of snares has been built without a stretch link (100% plastic coated steel cable). To accommodate the variable neck size of male and female ungulates, I modified the collar to have multiple catch mechanisms (like a one way zipper), so that it can close securely around a neck of any size (high or low, male or female). I have incorporated a small plastic linkage in the snare which degrades in UV light. Time to failure is as yet undetermined, but I expect it to last 2-3 years before it fails and the collar is shed. This weak link allows the animal to break the collar (34 kg breaking test) should it become inadvertently snagged, providing an addition safety feature. Finally, I have converted the snare from a passive type that closes as the animal pulls against it, to one that is yanked closed by a spring-loaded arm when tripped. Collectively, these changes should eliminate the initial problems we experienced and result in better capture success. Further testing will take place this winter on Etolin Island for elk. However, I will expand the testing and evaluation work to Douglas Island (using deer) where logistical costs associated with deployment and monitoring are much lower.

The cameras were not effective. They were relatively expensive (10-30 dollars per unit, depending on camera), bulky to transport in the field, and most importantly, failed to yield usable pictures. Trip mechanisms were unreliable, and when the shutter did trip (on 3 of 12 disturbed sets), no discernable image resulted. Furthermore, the camera trip wires may have provided enough resistance to cause elk to shy away from the snare noose and reduce capture success. For future efforts, I will eliminate the cameras and use the savings in time and money to deploy additional snares.

<u>JOB 4: Evaluate methods for estimating population size, cause-specific mortality, and patterns of habitat use/migration from passively radio-tagged animals.</u>

I made no progress on job 4 because no animals were successfully collared in Job 3. Engineers at Global Tracking Systems are developing a data-logger that will record time and date of elk passage, as well as frequency and strength of transmitters signal on marked animals. If sufficient numbers of elk can be collared and subsequently "recaptured" by this technology, I will be able to calculate a population size and confidence interval. But even with small sample sizes, useful information on habitat use and movement patterns of elk can be acquired by conventional aerial tracking.

III. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

Additional federal aid-funded work not specifically covered by the existing work plan included:

(1) Conversion of my hard reprint files to a computerized system (in progress).

As my filing system has grown in size and complexity, my current system for organizing and retrieving reprints has become unwieldy. It was impossible to cross-reference reprints, search by field (author, title, keyword), or automatically create and format literature cited sections for publications. Within the last 5 years, there has been dramatic growth in the capability of bibliographic software to accomplish these tasks. In preparation for this conversion, I read reviews of 8 bibliographic software programs and selected 4 that seemed suited to my particular needs (Bibliographix, Endnote 5, Citation 7, and Scholar's Aid). After experimenting with trial versions of each, I found that Citation 7 met my needs best. It is easy to learn, is seamlessly integrated with MSWORD, and offers a number of features more expensive programs do not. It creates literature cited sections for manuscripts at the press of a button, formatted to the exacting requirements of numerous journals (including the Journal of Wildlife Management). And it provides access to hundreds of university and government libraries via an optional module called BookWhere. Although the time I devote to converting my literature files to this new system will certainly impinge on the time I can spend writing manuscripts, this conversion, in the long-term, will yield great efficiencies.

(2) Hiring a WB 1 for the project (completed).

This job occupied a solid 2 week block of time considering the required training, advertising, interviewing and selection process. It was highly successful, however, and we have hired an excellent biologist in Kevin White.

(3) Field Work on Other projects

I spent a week conducting deer pellet-group surveys in the Wrangell area, a week helping the Juneau area biologist conduct moose browse surveys in Gustavus, a week helping a Ph.D. student with her black bear study on Kuiu Island; and a week helping a student with his deer study on the Queen Charlotte islands. This diverse field work was beneficial in terms of exposing me to new areas and ideas, and stimulating my thinking and writing. Moreover, this exposure allowed me to strengthen relationships with other biologists in and outside the Department for mutual benefit.

IV. RECOMMENDATIONS FOR THIS PROJECT

Recommendations for new Jobs:

(1) Creation of a brochure highlighting the unique ecology of wildlife and old growth in Southeast Alaska. The brochure would be aimed at large numbers of tourists (> 600 thousand) who visit Southeast Alaska each summer. An allocation of 8,000 dollars under a separate federal aid agreement has been earmarked for this work. I would provide editorial content, and coordinate with Michelle Sydeman in Headquarters on the project. A private contractor will provide graphics and layout work. I anticipate the project requiring 1–2 weeks of my time.

Otherwise, there are no new methods, jobs, or activities planned beyond what already been approved or is described in the job reports above.

V. PUBLICATIONS

See job 2 above for a list of citations. Abstracts are attached in the appendix.

VI. FEDERAL AID TOTAL PROJECT COSTS FOR THIS SEGMENT PERIOD

$93,297.66

VII. PREPARED BY: APPROVED BY:

<u>Matthew Kirchhoff</u>
Wildlife Biologist III

SUBMITTED BY:

<u>Kim Titus</u>
Research Coordinator

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Steven R Peterson, Senior Staff Biologist
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Wayne L Regelin, Director
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APPROVAL DATE: __________________

APPENDIX

UNDERSTORY AND BLACK-TAILED DEER IN OLD GROWTH FORESTS ON HAIDA GWAII (QUEEN CHARLOTTE ISLANDS) Christian Englestoft[1], Matthew Kirchhoff[2], Donald Eastman[1]

[1]University of Victoria, British Columbia, Canada
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Abstract: On Haida Gwaii, introduced Sitka Black-tailed Deer (*Odocoileus hemionus sitkensis*) caused considerably changed to the understory of old growth forests. The objective of this study was to examine the relationship between deer density and understory biomass. I estimated relative deer densities based on accumulated pellet groups. I developed regression equations to estimate the total, available and utilized biomass. At each sampling site, I sampled 15 shrub plots (4 m^2), 30 herbaceous plots (1 m^2) and 3 pellet group (PG) transects (167 m^2). I sampled 110 sites on the 3 largest islands. Relative deer density varied considerably and ranged from 0 to 1840 PG/ha. Of important deer forage, I encountered 6 shrub and 2 herbaceous species. Total aboveground biomass varied from 0-2136 kg/ha, and consisted mostly of Red Huckleberry (*Vaccinium parvifolium*). It was present in 108 sampling sites, and amounts varied from 0.03-2134 kg/ha. Saplings of Western Redcedar (*Thuja plicata*) (a tree species of concern) were only present on 1 site whereas seedlings grew on 35. Aboveground biomass was an order of magnitude greater than biomass available as forage. Expect for two outliers, available biomass ranged from 0-32 kg/ha (max 93 kg/ha). Utilized biomass ranged from 0.1 –22 kg/ha. No strong correlations were found between and the three components of understory biomass. Above 950 pg/ha, aboveground biomass was always below 83 kg/ha, suggesting that deer could keep understory to near-zero levels at high relative deer densities. Spatially I found some correlation between relative deer density and aboveground and available biomass.

EFFECTS OF EVEN-AGED TIMBER MANAGEMENT ON SURVIVORSHIP OF DEER IN SOUTHEAST ALASKA. Christopher Farmer[1], David Person[2], and Matthew Kirchhoff[2].

[1]State University of New York, College of Environmental Science and Forestry, Faculty of Environmental and Forest Biology, Syracuse, NY 13210 USA
[2]Alaska Department of Fish & Game, Division of Wildlife Conservation, Ketchikan, AK 99901 USA.
[3]Alaska Department of Fish & Game, Division of Wildlife Conservation, Douglas, AK 99824 USA

Abstract: Forest management in Southeast Alaska is dominated by clearcut harvesting of timber on private and public lands. Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) select productive old-growth forest and shrub/sapling communities within logged landscapes. Timber harvest has eliminated many stands of productive old-growth forest at low elevations, which are believed to comprise critical habitat for deer in winter; however, no evaluation of the relation

between habitat selection and fitness has been made for this species. We studied 76 radiocollared deer on a small (180-km2) island in Southeast Alaska to measure habitat use and associated survivorship in logged landscapes. We used radio-telemetry data and data on causes of mortality to examine effects of forest management practices on adult survivorship and fawn recruitment. Female fawns experienced low recruitment (0.39, n = 12), while all male fawns (n = 7) in the sample were recruited. The difference in recruitment of male and female fawns was associated with sex-specific differences in habitat composition of home ranges. Annual survivorships of adult females (0.81, n = 47) and males (0.73, n = 10) were similar, though dominant sources of mortality differed between sexes. Rates of wolf (*Canis lupus*)- and human-caused deer mortality were similar despite the remoteness of the study area. Using a GIS-intensive resampling technique, we compared habitat use and availability with the goal of identifying the habitat correlates of survivorship. We review these correlates in the context of current silvicultural management categories.

MODELING DEER-HABITAT RELATIONSHIPS ON THE TONGASS— WHERE WE'VE BEEN AND WHERE WE'RE GOING. Matthew Kirchhoff[1], Thomas Hanley[2]

[1]Alaska Department of Fish & Game, Division of Wildlife Conservation, Douglas, AK 99824 USA
[2]USFS Forestry Sciences Lab, 2770 Sherwood Lane, Juneau, AK 99801 USA.

***Abstract*:** Sitka-black tailed deer (*Odocoileus hemionus sitkensis*) have always been a high-profile species on the Tongass, not only because of their importance as a hunted game species, but as an ecological indicator. Deer-habitat relationships have been studied more extensively, and intensively, than any other species in Southeast Alaska. To assist in making land management decisions, biologists have tried to incorporate this knowledge into a framework known as models. These models have ranged from simple to complex, stochastic to deterministic, empirically based to opinion-based, and preference-based to nutrition-based. We review the history of these modeling attempts, highlighting the strengths and weaknesses of each approach, and suggest where future efforts might be profitably directed.

SCIENCE, POLITICS AND FOREST PLANNING-- STRANGE BEDFELLOWS?
Matthew D. Kirchhoff[1], Kimberly Titus[1],David K. Person[2]

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[2]Alaska Department of Fish & Game, Division of Wildlife Conservation, Ketchikan, AK 99901 USA.

Abstract: The Tongass land management plan has been touted as a science-based or science-driven plan. But what does this mean? Science can not direct decision-makers to a pre-determined endpoint. Ultimately the responsible decision-maker must weigh the conflicting demands of subsistence users, preservationists, different wildlife species, mill workers, and even

politicians, in arriving at a compromise plan that, to them, provides the greatest net good. These are very much value judgements—not scientific dictates. Accordingly, there is not a single scientifically "right" solution. When faced with public criticism, we should not retreat behind the shield of "science", nor should we impugn planning decisions we disagree with as "nonscience-based". Forest planning decisions necessarily reflect societal values, and are merely informed by our science. Science and politics are neither strange, nor inappropriate, bedfellows. Acceptance of this fact precedes meaningful communication with our critics. It also sets the stage for a thorny question that is frequently co-mingled in this debate. When the science seems clear, what is the role (or responsibility) of the scientist to advocate a particular outcome?

WINTER MORTALITY OF DEER IN A FRAGMENTED ISLAND ECOSYSTEM

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Abstract: Sitka black-tailed deer *(Odocoileus hemionus sitkensis)* mortality transects have been conducted in the spring along the beaches of southeast Alaska since the early 1960's, primarily as an index of winter mortality. Old-growth forest patches, or islands, adjacent to the beach provide critical low elevation winter habitat for deer. Forested islands are situated among a complex mosaic of muskegs and meadows, which is further fragmented by clearcuts. We evaluated the relationship between natural deer mortality and forest characteristics by delineating habitat patches based on winter home range estimates and seasonal use patterns. Preliminary analyses explored the relationship between carcass density and forest cover, weather variables, and estimated deer abundance. Temperature had the greatest influence on carcass densities ($P < 0.001$); as temperature decreased carcass densities increased. Additional landscape metrics including patch size, shape and insularity were calculated to evaluate the degree of fragmentation within the habitat patch. These metrics are used to make management recommendations for the retention of forest buffers to minimize further fragmentation and effects of timber harvesting on deer.

CHANGES IN AVAILABILITY OF *VACCINIUM* BROWSE DUE TO SNOWFALL IN SOUTHEAST ALASKA. Julien Schwartz[1], Matthew D. Kirchhoff[2]

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***Abstract*:** Measurements of habitat carrying capacity for deer require not only knowing how much food is produced in each habitat type, but how much of that food is available under varying snow conditions. We measured burial of browse on 100 *Vaccinium* plants near Juneau during

January-March 2001. We found that modest snow events of 3-4 inches accumulation resulted in relatively high reductions in available forage (20-30 percent). During the accumulation phase, when snow density was low, larger amounts of snow were needed to weight down and bury forage. Once buried, however, plants tended to remain buried even as snowpack melted down. The mild winter weather hampered ability determine the relationships under deep snow conditions.